Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Original) A method for determining the location of an alignment mark on a stage, the method comprising:

directing a measurement beam along a path between an interferometer and a mirror, wherein at least the interferometer or the mirror is mounted on the stage;

combining the measurement beam with another beam to produce an output beam comprising information about the location of the stage;

measuring from the output beam a location, x_1, of the stage along a first measurement axis;

measuring a location, x_2, of the stage along a second measurement axis substantially parallel to the first measurement axis;

calculating a correction term, ψ_3, from predetermined information characterizing surface variations of the mirror for different spatial frequencies, wherein contributions to the correction term from different spatial frequencies are weighted differently; and

determining a location of the alignment mark along a third axis parallel to the first measurement axis based on x_1, x_2, and the correction term.

2. (Original) The method of claim 1, wherein x_1 and x_2 correspond to the location of the mirror at the first and second measurement axes, respectively.

3. (Original) The method of claim 1, wherein the correction term, ψ_3, is related to departures of the mirror surface at the first measurement axis from a straight line.

4. (Original) The method of claim 1, wherein the correction term, ψ_3, is related to an integral transform of X_2 - X_1, wherein X_2 and X_1 correspond to x_2 and x_1 monitored while scanning the stage in a direction substantially orthogonal to the first and second measurement axes.

5. (Original) The method of claim 4, wherein the integral transform is a Fourier transform.

6. (Original) The method of claim 4, wherein contributions to ψ_3 from different spatial frequency components of variations of the mirror surface are weighted to increase the sensitivity of ψ_3 to spatial frequency components near K_d and harmonics of K_d, wherein K_d corresponds to the $2\pi/d$ where d is a separation between the first and second measurement axes.

7. (Original) The method of claim 3, wherein the alignment mark location is related to a location, x_3, on the third axis given by

$$x_3 = x_1 + \eta(x_2 - x_1) - \psi_3,$$

wherein η is related to a separation between first measurement axis and the third axis.

8. (Original) The method of claim 1, wherein the predetermined information is compiled by monitoring x_1 and x_2 while scanning the stage in a direction substantially orthogonal to the first and second measurement axes.

9. (Original) The method of claim 1, further comprising monitoring the location of the stage along a y-axis substantially orthogonal to the first measurement axis.

10. (Original) The method of claim 9, wherein the location of the alignment mark along the third axis depends on the location of the stage along the y-axis.

11. (Original) The method of claim 1, wherein the measurement beam reflects from the mirror more than once.

12. (Original) A method comprising:

correcting measurements of a degree of freedom of a mirror relative to a first axis made using an interferometry system based on information that accounts for surface variations of the mirror for different spatial frequencies, wherein contributions to the correction from the different spatial frequencies are weighted differently.

13. (Original) The method of claim 12, wherein the interferometry system monitors a degree of freedom of the mirror along a second axis and a third axis, wherein the second and third axes are parallel to and offset from the first axis.

14. (Original) The method of claim 13, wherein contributions to the correction from different spatial frequency components of variations of the mirror surface are weighted to increase the sensitivity of the correction to spatial frequency components near K_d and harmonics of K_d, wherein K_d corresponds to the $2\pi/d$ where d is a separation between the second and third axes.

15. (Original) A method comprising:

interferometrically monitoring locations X_1 and X_2 of a mirror surface relative to respective parallel axes while translating the mirror surface along a path substantially orthogonal to the parallel axes; and

determining from the monitored mirror locations contributions from different spatial frequencies to surface imperfections of the mirror.

16. (Original) An apparatus comprising:

an interferometer configured to produce an output beam comprising a phase related to an optical path difference between two beam paths, at least one of which contacts a mirror surface; and

an electronic controller coupled to the interferometer, wherein during operation the electronic controller determines a position, x_1, of the mirror with respect to a first measurement axis based on information derived from the output beam and an error correction term that accounts for surface variations of the mirror for different spatial frequencies, wherein contributions to the error correction term from the different spatial frequencies are weighted differently.

17. (Original) The apparatus of claim 16, further comprising a second interferometer configured to produce a second output beam comprising a phase related to an optical path difference between two beam paths, at least one of which contacts the mirror surface, wherein during operation the electronic controller determines a position, x_2, of the mirror with respect to a second measurement axis based on information derived from the output beam.

18. (Original) The apparatus of claim 16, wherein the first measurement axis is parallel to the second measurement axis.

19. (Original) The apparatus of claim 18, wherein during operation the electronic controller determines a position, x_3, of a mark with respect to a third axis based on x_1, x_2, and the error correction term, wherein the third axis is parallel to and offset from the first and second measurement axes.

20. (Original) A lithography system for use in fabricating integrated circuits on a wafer, the system comprising:

a stage for supporting the wafer;

an illumination system for imaging spatially patterned radiation onto the wafer;

a positioning system for adjusting the position of the stage relative to the imaged radiation; and

the apparatus of claim 16 for monitoring the position of the wafer relative to the imaged radiation.

21. (Original) A lithography system for use in fabricating integrated circuits on a wafer, the system comprising:

a stage for supporting the wafer; and

an illumination system including a radiation source, a mask, a positioning system, a lens assembly, and the apparatus of claim 16,

wherein during operation the source directs radiation through the mask to produce spatially patterned radiation, the positioning system adjusts the position of the mask relative to the radiation from the source, the lens assembly images the spatially patterned radiation onto the wafer, and the apparatus monitors the position of the mask relative to the radiation from the source.

22. (Original) A beam writing system for use in fabricating a lithography mask, the system comprising:

a source providing a write beam to pattern a substrate;

a stage supporting the substrate;

a beam directing assembly for delivering the write beam to the substrate;

a positioning system for positioning the stage and beam directing assembly relative one another; and

the apparatus of claim 16 for monitoring the position of the stage relative to the beam directing assembly.

23. (Currently Amended) A lithography method for use in fabricating integrated circuits on a wafer, the method comprising:

supporting the wafer on a moveable stage;

imaging spatially patterned radiation onto the wafer;

adjusting the position of the stage; and

monitoring the position of the stage, the monitoring comprising measuring a degree of freedom of a mirror using an interferometry system, where the mirror or a component of the interferometry system is attached to the stage, and using the method of claim 12 to correct the measurement of the degree of freedom.

24. (Currently Amended) A lithography method for use in the fabrication of integrated circuits comprising:

directing input radiation through a mask to produce spatially patterned radiation;

positioning the mask relative to the input radiation;

monitoring the position of the mask relative to the input radiation, the monitoring comprising measuring a degree of freedom of a mirror using an interferometry system, where the mirror or a component of the interferometry system is attached to the stage, and using the method of claim 12 to correct the measurement of the degree of freedom; and

imaging the spatially patterned radiation onto a wafer.

25. (Currently Amended) A lithography method for fabricating integrated circuits on a wafer comprising:

positioning a first component of a lithography system relative to a second component of a lithography system to expose the wafer to spatially patterned radiation; and

monitoring the position of the first component relative to the second component, wherein the first or second component comprises a mirror and the monitoring comprises measuring a degree of freedom of the mirror and using the method of claim 12 to correct the measurement of the degree of freedom.

26. (Currently Amended) A method for fabricating integrated circuits, the method comprising:

applying a resist to a wafer;

forming a pattern of a mask in the resist by exposing the wafer to radiation using the lithography method of claim 23; and

producing an integrated circuit from the wafer.

27. (Currently Amended) A method for fabricating integrated circuits, the method comprising:

applying a resist to a wafer;

forming a pattern of a mask in the resist by exposing the wafer to radiation using the lithography method of claim 24; and

producing an integrated circuit from the wafer.

28. (Currently Amended) A method for fabricating integrated circuits, the method comprising:

applying a resist to a wafer;

forming a pattern of a mask in the resist by exposing the wafer to radiation using the lithography method of claim 25; and

producing an integrated circuit from the wafer.

29. (Currently Amended) A method for fabricating integrated circuits, the method comprising:

applying a resist to a wafer;

forming a pattern of a mask in the resist by exposing the wafer to radiation using the lithography system of claim 20; and

producing an integrated circuit from the wafer.

30. (Currently Amended) A method for fabricating integrated circuits, the method comprising:

applying a resist to a wafer;

forming a pattern of a mask in the resist by exposing the wafer to radiation using the lithography system of claim 21; and

producing an integrated circuit from the wafer.

31. (Currently Amended) A method for fabricating a lithography mask, the method comprising:

directing a write beam to a substrate to pattern the substrate;

positioning the substrate relative to the write beam using a stage; and

monitoring the position of the substrate relative to the write beam, the monitoring comprising measuring a degree of freedom of a mirror using an interferometry system, where the mirror or a component of the interferometry system are attached to the stage, and using the method of claim 12 to correct the measurement of the degree of freedom.

32. (New) An apparatus comprising:

an interferometer configured to produce an output beam comprising a phase related to an optical path difference between two beam paths, at least one of which contacts a mirror surface; and

a means for determining a position, x_1, of the mirror with respect to a first measurement axis based on information derived from the output beam and an error correction term that accounts for surface variations of the mirror for different spatial frequencies, wherein contributions to the error correction term from the different spatial frequencies are weighted differently.

<u>Amendments to the Drawings</u>:

The attached replacement sheets replace the original sheets including Fig. 1 – Fig. 7.

Attachments following last page of this Amendment:

Replacement Sheet (8 pages)